

Radiation-Tolerant Vertical-Cavity Amplifying Detectors for Time-of-Flight Laser Rangefinders, Phase I

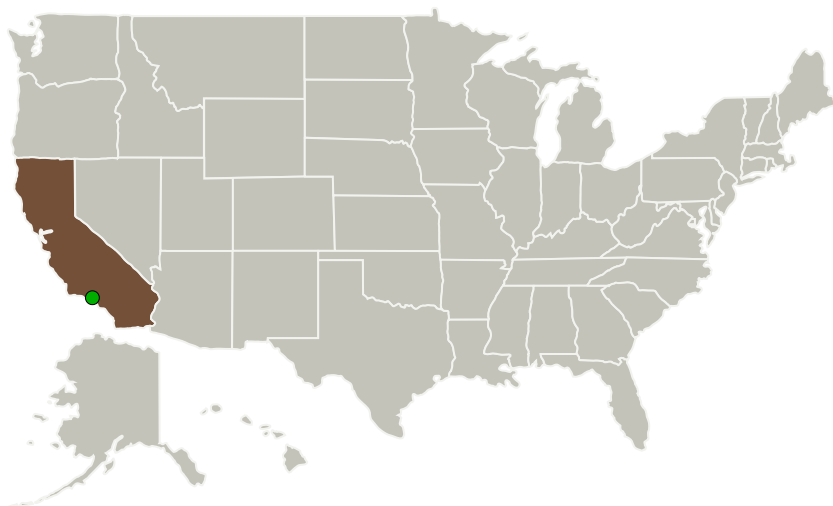
Completed Technology Project (2011 - 2011)



Project Introduction

The harsh radiation environment anticipated during the Europa Jupiter System Mission (EJSM) presents a significant challenge to develop radiation-hardened notional instruments. A high-performance, radiation-tolerant detector is required for the time-of-flight laser altimeter system on the Jupiter Europa Orbiter (JEO), which will perform critical characterization of Europa's topography, ocean tides, and ice shelf. Avalanche photodiodes (APDs) are conventionally chosen as detectors for standard laser altimeter systems. However, the performance of APDs degrades significantly after exposure to high levels of radiation. Aerius Photonics proposes to develop a novel radiation-tolerant detector that is suitable for use in space-based laser-altimeter systems by integrating a Vertical-Cavity Semiconductor Optical Amplifier (VCSOA) with a PIN photodetector. The resulting device, known as a Vertical-Cavity Amplifying Detector (VCAD), is expected to provide high-gain, high-speed, low-noise detection and demonstrate significant improvements in radiation tolerance over APDs. The optical preamplification provided by the VCSOA, along with its operation as a forward-biased majority-carrier device, renders the VCAD system insensitive to radiation-induced increases in detector dark current noise and receiver electronics noise. The VCAD is also expected to be significantly less susceptible to single event transients (SETs) than an APD. Aerius Photonics has expertise in VCSOA development and has already demonstrated basic radiation tolerance of VCSOAs to 300 krad with gamma radiation and to 300 krad with 63 MeV protons. In Phase I of this program, Aerius will design, fabricate and characterize VCADs that have been exposed to a more comprehensive radiation test plan that will include conditions anticipated on the EJSM.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
Aerius Photonics, LLC	Lead Organization	Industry	Ventura, California
● Jet Propulsion Laboratory(JPL)	Supporting Organization	NASA Center	Pasadena, California

Primary U.S. Work Locations

California

Project Transitions

**February 2011:** Project Start**September 2011:** Closed out

Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/138443>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Aerius Photonics, LLC

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

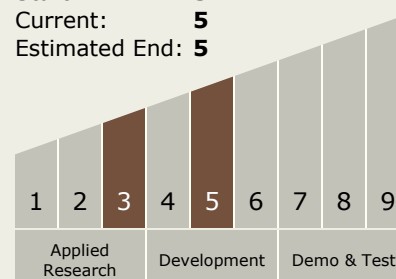
Carlos Torrez

Principal Investigator:

Timothy Strand

Technology Maturity (TRL)

Start: 3
Current: 5
Estimated End: 5



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Technology Areas

Primary:

- TX08 Sensors and Instruments
 - └ TX08.1 Remote Sensing Instruments/Sensors
 - └ TX08.1.1 Detectors and Focal Planes

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System